Claims

A new method for determining in-situ bulk tortuosity of the interconnected pores of reservoir rock, and estimating the bulk permeability of a reservoir formation between seismic transmitters and seismic receivers, such method comprising 1-7 below: (amended)

1. Transmit a monofrequency signal generated by a seismic transmitter or seismic transmitters and received by a seismic receiver or seismic receivers. (Amended)

2. Analyze the spectral content of the received signal. (Amended)

3. Identify the side lobes of the monofrequency signal that was transmitted. (Amended)

4. The frequency of the side lobes represents (F - Fdrag) and (F + Fdrag), where F is the monofrequency and Fdrag is the frequency of the 'Drag Wave'; these side lobes are generated due to the elastic nonlinear interaction between the monofrequency wave traveling through the rock matrix and the 'Drag Wave' being generated due to the coupling between the matrix and pore fluids. (Amended)

5. Calculate the velocity of the 'Drag Wave' Vdrag by using the Doppler Effect in which Fdrag/F = Vdrag/(V - Vdrag); where Fdrag is the frequency of the 'Drag Wave' (see 4 above), F is the monofrequency, Vdrag is the velocity of the 'Drag Wave' and V is the velocity of the monofrequency signal. (Amended)

6. The bulk tortuosity of the inter-well reservoir rock formation can be estimated by: $Vdrag = Vfluid/\sqrt{T}$, where Vdrag is the velocity of the 'Drag Wave', T is tortuosity, and Vfluid is the compressional velocity of the pore fluids. (Amended)

7. Once bulk tortuosity has been estimated, bulk permeability can be estimated using Scheidegger's equation $K = \varphi\, r^2 / 8T$ or other equations generated by Kelder or Peeters. (Amended)

8. The method of claims 1-7 specifically used to determine in-situ bulk tortuosity of the interconnected pores of reservoir rock, and estimating the bulk permeability of a reservoir formation connected between two wells. (Amended)

9. The method of claims 1-7 specifically used to determine in-situ bulk tortuosity of the interconnected pores of reservoir rock, and estimating the bulk permeability

Sub B. A[1] of a reservoir formation in a well between two depth points in that well.
(Amended)